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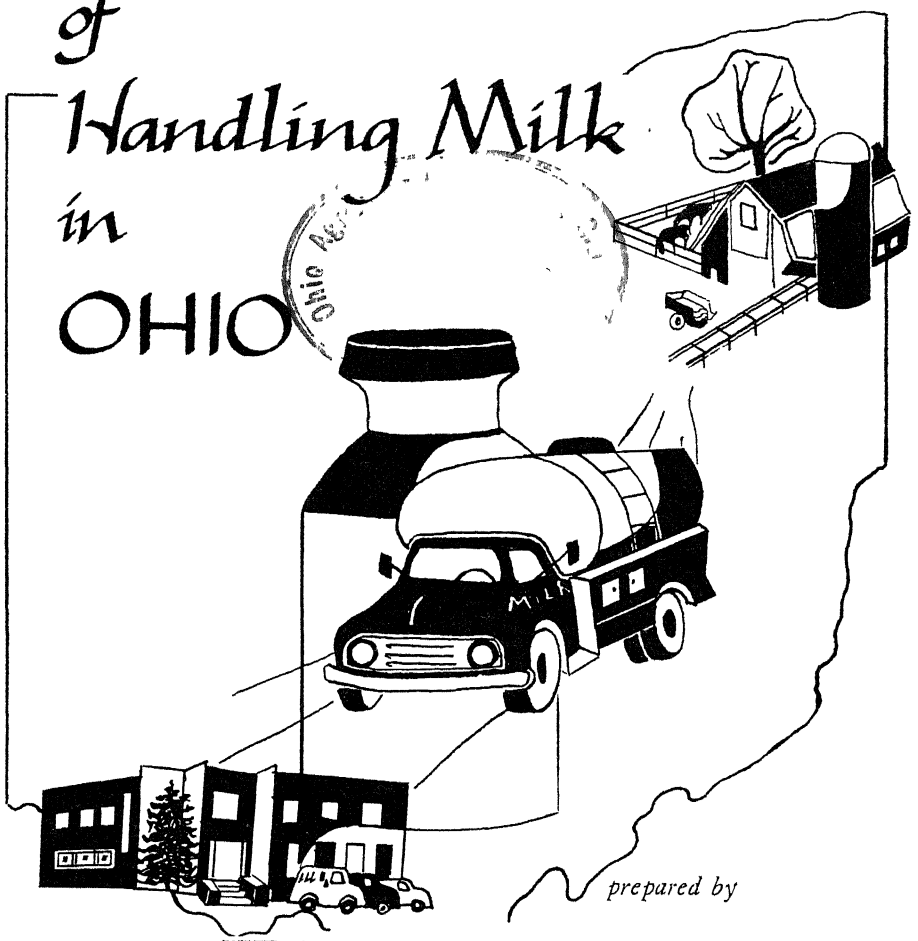
Bulk Tank System of Handling Milk in OHIO



prepared by

THE OHIO AGRICULTURAL EXTENSION SERVICE

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AGRICULTURAL ECONOMICS

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farm management

DAIRY TECHNOLOGY

DAIRY SCIENCE

AGRICULTURAL ENGINEERING

Contents

The combined efforts of four Extension Service departments of the Ohio State University provide a "package" approach to the factors involved in the change from cans to the bulk tank system of handling milk on the farm.

Although many tanks are in use and many more tank installations are being contemplated by producers, production of milk in cans will be part of our dairy marketing structure in Ohio for some years to come. Economics may not permit the wide spread use of tanks in the manufacturing milk markets in Ohio.

Department of Agricultural Economics

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The Bulk Tank System of Handling Milk
in Ohio

What should a dairyman consider if he must choose between changing to bulk handling or quitting the dairy business?

What are the facts?

Bulk Handling Grows Fast

The use of the bulk tank system of handling milk on the farms has spread rapidly since the system was first introduced in California in 1939. Ohio reported its first bulk tanks in 1952. It is estimated that by the end of 1957, approximately 4000 tanks were in use in Ohio.

Although many Ohio farmers have threatened to give up dairying if they are forced to install a bulk tank system, the trend to this type of handling milk has increased steadily. Research indicates that bulk handling changes the marketing pattern.

The change from cans to bulk tanks involves problems in farm management, production patterns, buildings, electrical power and sanitation.

If the producer is asked by the handler to make the change, he has only three choices:

1. Make the change and comply.
2. Change to another milk handler.
3. Discontinue the dairy business.

Those who want to make the change and those who are forced to change, need to take a "cool and calculated" look at all the factors involved.

The Future of Dairying in Ohio

The dairy business is the largest single source of Ohio farm income. Population trends indicate a continuing and expanding demand for dairy products. If the supply to meet this demand is not found in Ohio, it will be received from outside of the state.

Milk and dairy products move freely from one area to another. The Ohio dairy farmer is in direct competition with dairy farmers of other areas.

Continuous improvement in efficiency of production and mareting will be necessary to provide the consumer with a fresh, wholesome product at a reasonable price.

Orderly marketing is essential. Any insistence by one segment of the dairy business to gain unjustified advantage over another will only serve to jeopardize the future of dairying in Ohio.

Bulk Handling Has Advantages

Bulk handling avoids some losses in weight of milk and usually results in slightly higher butterfat tests. Handlers frequently pay premiums for bulk delivery but do not guarantee premiums for a fixed period of time. The most common premium has been 10 cents per hundredweight. Some handlers do not pay premiums.

Hauling rates may be lower. Usually, the farmer can expect a reduction of 5 to 10 cents per hundredweight. Every-other-day pickup makes the largest saving in hauling cost.

A recent study[1] indicates that total financial incentives for bulk handling averaged 12.8 cents per hundredweight. There is little evidence that weight or butterfat readings will increase significantly, if the producer was doing a good job before changing from cans to bulk handling.

What do Bulk Tanks cost?

Range of FOB Price is:

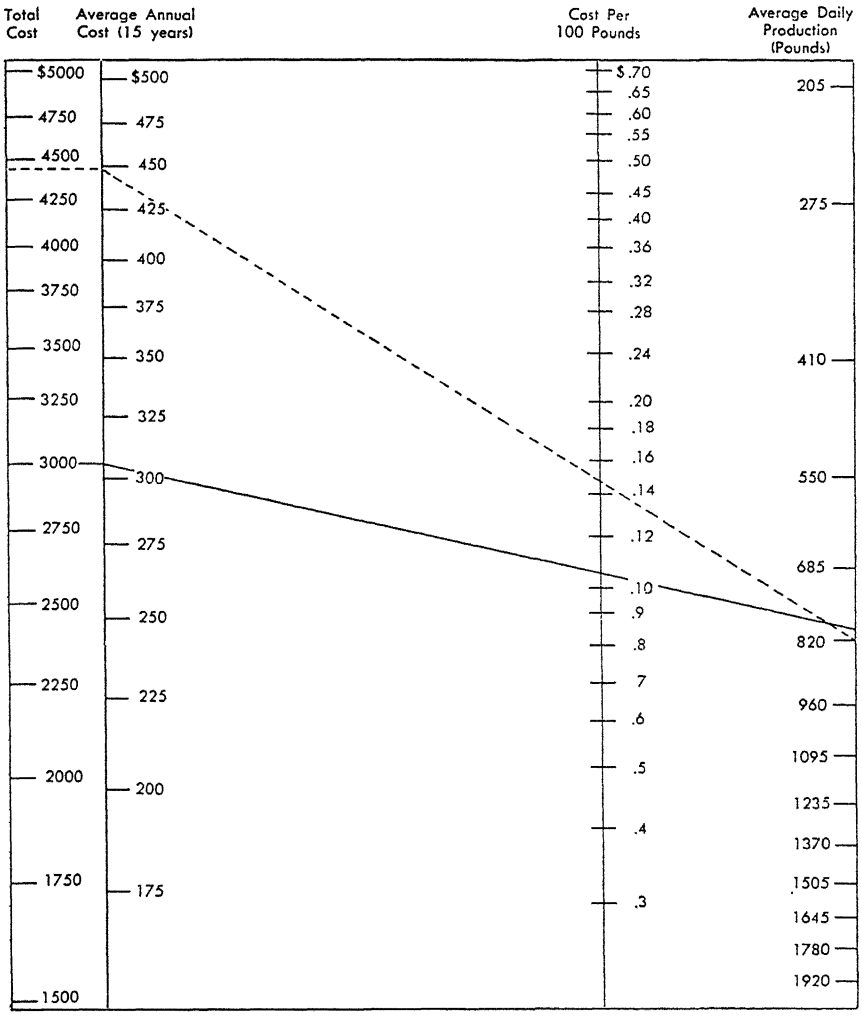
100-gallon tank	$1180 to $1700
200-gallon tank	1830 to 2200
400-gallon tank	2600 to 3030
700-gallon tank	3350 to 3760

NOTE: Freight from factory and cost of installation must be added to estimated total cost.

[1] "Bulk Tank Practices in Ohio"—E. F. Baumer and Dale H. Carley

A 300-gallon bulk cooling tank will cost around $2500 less any discount or trade in you may be able to get. Figuring to spread this cost over 15 years, the Bulk-O-Meter plan[2] will act as a rule-of-thumb method to tell how much you may expect to save or lose when you make the switch.

Bulk-O-Meter



[2] Ohio Agricultural Experiment Station, Department of Agricultural Economics 9/56

To use the Bulk-O-Meter for changing total costs into cost per hundredweight, the first step is to find the point on the left scale that represents your **total** investment. Reading across to the second line on the left of the diagram changes this total cost into cost per year based on a 15-year life of the tank. This annual cost has been calculated to include interest at 5 percent, depreciation and repairs.

The next step is to spot on the extreme right column your average production in pounds per day. The next step is to connect the points on the annual cost line with that on the production line. The point at which this line crosses the cost per hundredweight line (second on the right) indicates the cost per hundredweight to the farmer on this investment.

For example, a dairy farmer may have a total cost of $3000 in changing to bulk and an average daily production of 800 pounds of milk. This would result in an average annual cost of about $310 per year and a cost per hundredweight of approximately 10½ cents.

Assuming a farmer's present can-cooling cost is 3 cents per hundredweight, he (under these assumptions) must obtain additional returns of approximately 7½ cents over 15 years to pay for the tank. These additional returns may come from one or a combination of lower hauling rate, premiums and reduced losses on milk weights and butterfat.

For example, a dairy farmer may receive a 10-cent reduction in hauling rates, 10 cents bonus from the dealer, and 4 cents return on weight and test, or a total of 24 cents. This, then, returns a net of 16½ cents (24¢—7½¢ = 16½) to the farmer. This will reduce to about five years the length of time required to pay off the tank.

Many Figures Needed to Estimate Costs

How much will the use of bulk tank equipment add to my marketing costs?

Form for Use in Estimating Added Costs

(Use your own costs and rates)

Annual cost of owning bulk tank (excluding power costs)

a. Annual interest charge: installed price divided by two, then multiplied by the prevailing interest rate, equals..... .....

b. Annual depreciation allowance: installed price divided by 15 (years life) equals.... .....

c. Estimated annual upkeep expense: installed price times 2 percent..... .....

d. Annual property tax: tax duplicate value times insurance rate equals..... .....

e. Annual insurance premium: insured value times insurance rate equals..... .....

Estimated total annual cost of owning bulk tank ..... (A)$.....

Annual cost of owning new or remodelled buildings needed:

a. Annual interest charge on investment in buildings: cost divided by 2, then multiplied by 6 percent, equals..... .....

b. Annual depreciation allowance on new improvement: cost divided by years of life equals ....

c. Annual insurance premium on new improvement: insured value times rate equals .....

d. Annual upkeep expense on new improvement: cost times 2 percent equals..... .....

Total estimated annual cost of owning new improvement ..... (B)$.....

Estimated total cost of owning tank and necessary new building improvement....(A + B) (C)$.....

Savings or credits attributed to use of bulk tank:

a. Differential paid to producer: cwt. delivered times differential per cwt. equals.... .....

b. Elimination of maintaining can equipment: cwt. shipped times 2 cents per year equals ....

c. Reductions in losses from spilling, sticking, etc.: cwt. shipped times 2 cents per cwt. ....

Estimated total credits from use of bulk tank equipment ..... (D)$.....

Net increase in shipping costs with bulk tank equipment .....(C — D) (E)$.....

Other Questions to Consider

How many cows would I have to add to my herd to avoid an increase in the per hundredweight cost of marketing milk with bulk tank equipment?

1. The following data will be helpful in determining number needed under present cost-price relationships:

   Cows which will produce 6500 lbs. milk per year will pay about $60 of added cost. Cows which will produce 8500 lbs. of milk per year will pay about $120 of added cost. Cows which will produce 10,000 lbs. of milk per year will pay about $160 of added cost. Cows which will produce 12,000 lbs. of milk per year will pay about $225 of added cost. FORMULA: for estimating increase in cows needed to carry additional cost. Net increase in cost (E, above) divided by amount each added cow will pay equals number to be added. For example: If 6500 lb. cows are added and the additional cost figured $540 per year then $540 divided by 60 equals 9 cows, or number to be added. If 10,000 lb. cows are added and the additional cost figured $540 per year, then $540 divided by $160 equals 3.4 cows (rounded out would be 4 cows) to be added.

How large a tank should I buy?

Figure the future expansion of your herd first. Then the minimum size tank should hold five milkings during peak production. All tanks are most efficient when being used at capacity. Therefore, even production is essential. It is too costly to operate a tank at half capacity during part of the year. Bulk tank systems have a tendency to even out production patterns.

What type should I buy?

There are two types of tanks, "Ice Bank" and "Direct Expansion." Ice bank type builds up ice on coils then circulates ice water around the walls of the tank. This type usually requires a smaller compressor and motor but needs a circulating pump for the water. It is impossible for the milk to freeze with this type.

The direct expansion has cooling coils placed against the bottom and inside liner of the tank and is usually more efficient. Direct expansion does require a larger motor and compressor and it is possible to freeze milk.

The initial cost of the ice bank tank is less than direct expansion, but operating costs are somewhat higher. In the long run, there appears to be little overall cost difference.

What adjustments are needed in my farm lease?

This depends upon whether the landlord is responsible for financing the tenant. If the landlord purchases and installs bulk tank and pipeline milkers, then the landlord would be furnishing more capital and the tenant less labor. However, if the tenant purchases and installs the equipment, the tenant would furnish less labor per hundredweight of milk, but more capital. Any adjustments in a lease agreement should reflect increases or decreases in labor and capital provided by the parties to the contract.

How can a tenant finance a purchase of this type and protect his investment?

The tenant could receive all premiums paid by milk buyers and savings on hauling until he has recovered his capital. Also, the landlord could give the tenant a written lien on the equipment in writing until the tenant recovers his cost and permission to the tenant to move equipment if the lease terminates before the tenant has recovered his cost.

Milk House Requirements

Consult local milk authorities before starting to build or remodel a milk house. No set of plans can be adapted to all conditions.

Consider future needs before deciding upon the size of milk house to build. The minimum recommended dimension is 14 feet inside, if a bulk storage tank is used.

Milk house may or may not be attached to barn. If a vestibule is needed, it must be sealed, equipped with self-closing doors, a floor drain and be ventilated.

Arrangement of equipment, doors and windows is optional and depends upon the milk house location.

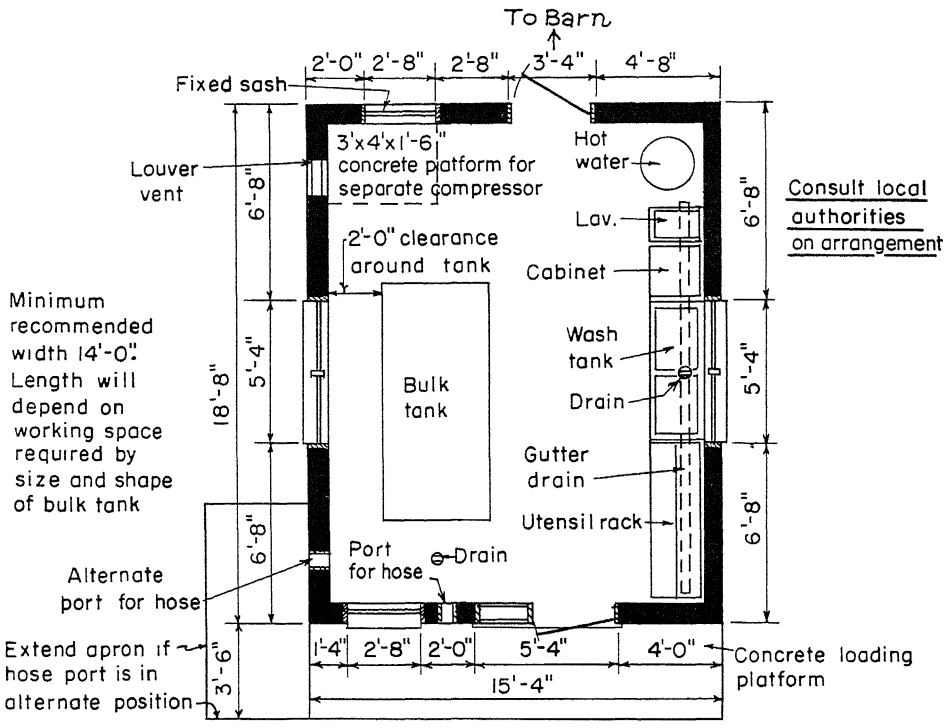
All doors should swing out and be self-closing. Windows should be high, should open in at the top and be screened.

Window class should be equal to 10 percent of the floor area, and adequate artificial light should be provided. Window sills should slope outward at 30 degree angles.

One outside door frame, including a removable panel, should open to a 5-foot width. This permits easy installation and removal of equipment.

Insulated ceiling and walls provide a cooler milk house in the summer and a warmer one in the winter.

Milk House for Bulk Milk



Artificial heat is desirable in the winter for the comfort of the workers and protection of the equipment.

Provision must be made for an adequate, safe water supply under pressure. Plumbing must be protected from freezing.

All of the equipment shown on the floor plans is highly desirable for the production of high quality milk.

Hose port must be 18 inches above ground level.

Electric Service – More Required

The change to bulk tank cooling makes it desirable, perhaps necessary, to consider the electric service for the milk house.

In most instances the electric service will have to be enlarged to take care of the increased demand. For the ice bank type, the

usual size for the compressor motor is ⅓ h.p. for each 50 gallons of milk cooled per milking. In addition, there is a small motor for the water circulating pump and one for the agitator. There may be one or more small motors for the condensor.

For the direct expansion type, the usual size of motor is 1 h.p. for each 50 gallons of milk cooled per milking. A separate small motor for the agitator is also required. Compressor motor sizes for every-other-day pick up may be as low as ⅓ h.p. for each 50 gallons per milking for the ice bank type to as high as 5 to 7½ h.p. for the direct expansion type for each 250 gallons per milking.

More hot water is needed for bulk milk coolers and for pipe line milkers. Electricity is commonly used to heat the water, so wiring must be adequate.

An outlet for the milk pump on the pick-up truck must be supplied.

Frequently it is desirable to supply positive ventilation for the milk house. An electric ventilation fan will do this.

Another use for electricity is the supply of additional heat, for the comfort of the worker, and to prevent pipes from freezing or ice from forming on the floor.

Lighting should provide two watts per square foot. There should be lighting outlets for both general lighting and for the work areas. It is also desirable to have convenient outlets near all work areas.

The electric service entrance for the milk house must be large enough to take care of all the electrical uses. If it is necessary to enlarge the present service, at least a 60-ampere capacity should be installed. Both 120- and 240-volt service will be needed.

Metal clad wiring is not recommended for the moist conditions which prevail in the milk house. Moisture-resistant plastic or synthetic rubber covered wiring should be used.

The cost of operation in cooling 100 pounds of milk in the direct expansion type is usually less than for the ice bank type. With electricity costing 2 cents for KW-hour, the cost of cooling 100 pounds of milk is approximately 2 cents for the direct expansion type and about 2½ cents to 3 cents for the ice bank type.

Over the life of the cooler, the total cost for the two types will be about the same. The lower operating cost of the direct expansion type is offset by the higher first cost and higher installation cost.

Pipeline Milkers

Before purchasing a pipeline milker, make sure that the equipment meets sanitation requirements. This information is available through the local milk sanitarian and/or the dairy plant fieldman.

All pieces of equipment which come in contact with milk must be 18-8 stainless steel or heat resistant glass. Both glass and stainless steel lines can be cleaned-in-place satisfactorily. The generally accepted standard for milk lines is 1½ inches in diameter. The joints must be tight to prevent any leakage and must be smooth to permit ease of cleaning.

Glass, in some cases, has a little lower cost, and the inner surfaces are visible. With stainless steel, there's little chance of breakage and steel permits greater flexibility in installation.

The vacuum and the non-vacuum bulk cooling tank can be used in combination with the milk pipeline. Consult the local sanitarian and the fieldman for the milk buyer to get their approval before any pipeline is installed.

Bulk Tank Standards

The 3-A Standards for the farm bulk tank are set up jointly by (1) International Association of Milk and Food Sanitarians, (2) U. S. Public Health Service, and (3) Dairy Industry Committee. These standards serve as a guide to equipment makers in meeting current minimum sanitary requirements.

Make certain your tank meets 3-A Standards. If there is any question, check with local inspector or dairy plant fieldman.

Cleaning has been a big problem because of the lack of proper selection and effective operation of equipment with pipeline milkers. Ordinary cleaning compounds will not do a satisfactory job. Special cleaning materials are available and should be used. Eight to nine gallons of hot water are generally required for each 100 feet of line washed with a pump. Usually less is needed with vacuum cleaning.

When installing a pipeline milker, **do not** support it from the beams; when the barn is filled with hay and/or equipment, the beams will give enough to create a sag in the line. Make certain the lines are rigid and that there is a minimum of movement of pipelines when the solutions begin to flow. Make certain that the lines are completely cleaned after each milking.

To help prevent a rancid flavor in milk, it is important that pipeline milkers be installed and operated in such a way as to keep air intake and foam formation during milking to a minimum.

Admit air at the claw in amounts necessary to keep up the milk flow from teat cups into lines.

Use fast milking techniques. If teat cups are left on cows too long, too much air will be sucked in around the cups.

Do away with milk tubes which are cracked.

Keep all connections tight. Check all of them periodically, especially those at weighting jars, at the releaser, and at the pumps.

Avoid admitting air to the milk through open pet cocks, vacuum regulators or other devices.

Wherever possible, do not use risers in the pipeline. Risers very often promote foaming action, and may cause milk to foam as it is forced to change its direction of flow at the riser.

Quality Safeguards

Since all of the milkings (generally four) between collections are added together, extra care should be used with a farm bulk tank.

Many off flavors are caused by bacteria which are generally found on milking machines and other milk handling utensils.

If none but high quality milk is introduced into the tank and held at 40°F. or below, very little change in bacteria numbers is likely. There are certain bacteria, however, which grow in milk held at 40°F. or below. They can cause off-flavors. Every effort to hold bacteria counts to a low level should be practiced at all times. High quality milk can be delivered with every-other-day pick up.

Farm tank trucks are insulated to prevent temperature rise while milk is being transported.

Mixing hot and cold milk is generally not a problem unless the temperature of the mixture rises above 55°. As the temperature gets higher, bacteria begin to grow rather rapidly, and quality problems may result.

Cleaning the Farm Bulk Tank

The milk producer is responsible for cleaning the farm tank. The following procedure or system should make the tank cleaning process easy and help insure a high quality product. The following materials should be on hand to save time in doing an effective job.

Cleaner recommended by dairy plant, fieldman or sanitarian.

Long handled brushes designed for farm tank cleaning. Also suitable hand brushes for valves, connections, etc.

Plastic or rubber pail to hold washing solution.

A suitable rack for cleaning materials, including the brushes and the plastic or rubber pails.

(IMPORTANT: All items coming in contact with the milk surfaces should be kept off the milk house floor, away from grit. This is another step toward the prevention of scratching the inner surfaces of the tank during the scrubbing process).

Steps in Cleaning

Rinsing—Immediately after the milk is withdrawn, rinse the tank thoroughly with cool or preferably, lukewarm water. This is usually done by the tank truck driver.

Scrubbing process—The first step in the actual cleaning process, once the rinsing is accomplished, is to scrub the main part of the tank with a long handled brush. The plastic or rubber pail containing the wash solution may be placed in the tank for convenience. Then scrub all inner surfaces well, including inside the covers. Give special attention to all corners and joints. Scrub all connections, valves, and small openings with brushes designed for that purpose.

Rinsing—After scrubbing, rinse all part of the tank with hot water. Rinsing is an important step because it removes material which has been loosened in the scrubbing process.

Sanitizing—Sanitize with an approved sanitizer such as chlorine (200 ppm) just prior to putting milk into the tank. Do not allow chlorine to remain in contact with stainless steel over one hour, or pitting may result.

Milk Fat Sampling

In converting from can to bulk handling one should not expect an increase in butterfat test provided the fat test for the can milk was accurate. Slightly more milk will be sold from tanks since loss of milk that sticks to the cans at the receiving plant is avoided. The test should average out about the same as it was with properly cooled milk in cans.

The hauler usually takes the samples before the milk is loaded. Two minutes of agitation is usually sufficient to obtain adequate mixing of the butterfat through the milk.

It is generally better to use the high speed agitator for **butterfat sampling** purposes and the slow speed agitator for cooling.

Churning may be caused by agitating milk at a temperature above 55° or agitating at a high rate of speed. Therefore, it is suggested that all milk be cooled at 40°F. or below as soon after milking, using the slow speed agitator. If too much warm milk is added to cold milk without continuous agitation the warmed up mixture is likely to churn during agitation.

Milk from high fat breeds of cattle has large fat globules compared to other dairy breeds; and as a result, their milk is more susceptible to churning.

Summary

The break-even point between bulk handling and can handling of milk depends on more than the number of cows in the herd. The foregoing factors indicate problems of operation cost, future production, markets, potential income, and many other personal factors that could influence your decision. In some cases a dairyman may change to bulk system as a matter of convenience rather than economy, or as the only way to continue to hold an outlet for his milk.

Bulk tank handling favors larger producers. You may be forced to make a decision on short notice. Study the factors suggested here and make a definite plan for the future in your dairy business. Check with the dairymen who have made the change to clarify the above considerations, guides and facts.

Producers' Advantages with Bulk Tanks

1. Eliminate cost and maintenance of milk cans.
2. Eliminate physical strain of can handling.
3. Lower hauling costs with every-other-day pick up.
4. Producers sell their milk at the farm.
5. Producers can check tests and weights if they wish.
6. Chores are easier when pipelines are used.
7. May reduce losses on weight and butterfat.
8. May receive a bonus.
9. Producer pays closer attention to milk quality.

Producers' Disadvantages

1. High initial investment in equipment.
2. All-weather driveway and road needed.
3. Rewiring and remodeling of milk house may be necessary.
4. Thorough cleaning of bulk tank equipment must be done by producer.
5. Failure to pay close attention to milk quality may result in the loss of an entire tank of milk instead of only a can.

BULK TANK HANDLING OF MILK IS SPREADING RAPIDLY AND WILL CONTINUE TO SPREAD. WHEN THE TIME COMES, BE READY TO MAKE THE RIGHT DECISION.

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